Net Job Creation in the US Economy: Lessons from Monthly Data, 1950-2011

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15 April 2014

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Abstract

This paper studies the monthly net job creation (NJC) at the aggregate and the sectoral levels in the U.S. over the period 1950-2011. The paper has few important findings. First, NJC did not show a significant trend over the last six decades, which led to a fall in the NJC rate. Second, NJC was very volatile and it could change course even in the span of one month. Third, there was no clear pattern about the co-movement between NJC and the change in the unemployment rate. Fourth, the averages of total NJC and private NJC since late 2010 were significantly higher than their respective historical averages and the volatility in NJC since the end of the Great Recession was not unusual by historical standards. Fifth, while the evidence about the effects of the 2009 American Recovery and Reinvestment Act on employment is inconclusive, some sectors appeared to benefit from it. Finally, the most frequent drop in the unemployment rate was by 0.1 percent, and drops of more than 0.2 percent should not be highly expected.

JEL Classification: E24; J21; J60.

Keywords: U.S. net job creation; U.S. unemployment rate; U.S. labor Force; The Great Recession.

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I. Introduction

In recent years, net job creation (NJC) has been the subject of ample discussion in the U.S. as the economy is recovering from the Great Recession. Many have been puzzled by the unrobust net job creation in the economy and the slow fall of the unemployment rate. In order to put the behaviour of net job creation in recent years in perspective, this paper studies the evolution of U.S. net job creation from January 1950 to December 2011. The paper primarily focuses on the "aggregate" level of NJC rather than firm-level, industry-level NJC or other aspects of NJC. The main issues discussed in this paper are the size and volatility of monthly NJC over time, the co-movement between NJC and the changes in the unemployment rate and the co-movement between NJC and the changes in the labor force.

The main findings of the paper are as follows. First, in roughly 75 percent of the months reviewed, the U.S. economy had net job gains. The remaining months, but one, witnessed net job losses. The average and median of NJC in months with positive NJC were slightly above 200 thousand. In months with net job losses, the average and the median were around (-170) thousand and (-120) thousand, respectively. The overall average and median had been about 120 thousand and 150 thousand, respectively. Also, NJC did not exhibit a significant trend, particularly since the 1960s, and it was very volatile during the period investigated (sometimes, changing direction within a month). The lack of a trend in NJC is interesting given the significant increase in the U.S. population and labor force over time.

Second, the average of NJC during 2000-2009 was lower than in previous decades: a decline from an average of about 180 thousand in the 1990s to (-10) thousand in the 2000s. Ignoring 2008 and 2009, the monthly average for 2000-2007 becomes roughly 80 thousand, which is very low even compared to the 1950s. Furthermore, by considering only years with positive NJC, the 2000s had low NJC in historical standards: a monthly average of 135 thousand jobs compared to roughly 210 thousand jobs during the 1970-1999 period. In other words, a difference of about 900 thousand jobs each year, on average, compared to the previous three decades.

Third, no clear pattern about the co-movement between NJC and changes in the unemployment rate is observed. In roughly one third of the time, a fall in the unemployment rate was accompanied by net job gains. However, in about 20 percent of the time, the unemployment rate increased despite net job gains and, in another 20 percent of the cases, the unemployment rate remained unchanged despite net job gains. In total, in more than 50 percent of the time with positive NJC, the unemployment rate did not fall that month. Also, in roughly one third of the months with negative NJC, the unemployment rate did not increase. Moreover, the likelihood of a rise in the unemployment rate in a month with net job losses is higher than the likelihood of a fall in the unemployment rate in a month with net job gains. The finding about

the unrobust correlation between NJC and the changes in the unemployment rate holds also for different sub-periods and time spans.

Fourth, Between December 2007 and December 2011, the U.S. economy lost about 120 thousand each month, on average. NJC had been more volatile than in previous periods, partly due to the movement from negative NJC during the first part of this sub-period to positive NJC in its second part. As said above, very high NJC volatility is not uncommon in a historical perspective. Furthermore, since September 2010, which was the last month with negative NJC, the average of monthly NJC had been above 150 thousand, which is higher than the historical average. The standard deviation actually decreased dramatically since October 2010 and the standard deviation since May 2009, the last official month of the Great Recession, was very similar to its pre-December 2007 level.

Fifth, the most likely change in the monthly unemployment rate is 0.1 percent (in absolute value), mainly in months with falls in the unemployment rate. In 53 percent of the months with negative changes in the unemployment rate, it dropped by 0.1 only. And, in 47 percent of the months with positive changes in the unemployment rate, it rose by 0.1 only. Monthly changes of 0.2 (in absolute value) are very likely too, with 20 percent of the monthly changes being by this size. In about 77 percent of the months during which the unemployment rate changed, the monthly change was up to 0.2 (in absolute value). Therefore, bigger changes in the unemployment rate, particularly bigger drops, should not be expected to happen frequently.

Sixth, private NJC constituted, historically, about 82 percent of total NJC in the U.S. economy and the rest of NJC was government-made. Since the beginning of the Great Recession both types of NJC declined. But, since the end of the recession, private NJC became positive whereas government NJC remained negative. Also, since October 2010, private NJC had been significantly higher than its historical average whereas government NJC continued to decline. On average, more than 170 thousand jobs were created each month, in net terms, by the private sector since October 2010.

Seventh, most of the analyses at the aggregate level hold also at the sectoral level. Furthermore, the sector-level analyses reveal that, on average, net job creation in the manufacturing sector had been roughly zero since 1950, which resulted in a decline in the importance of this sector for employment over time. net job creation in the educational services sector and health care and social assistance sector remained relatively unchanged during the recent economic meltdown. Net job creation in the leisure and hospitality sector recovered very quickly from the recession despite its nature. On the other hand, net job creation in the financial services declined significantly and its recovery was muted compared to the overall economy. Furthermore, even though the employment in the services-providing sector is roughly five times the employment in the goods-producing sector, the decline in employment in the goods-producing

sector was clearly bigger than the decline in the employment in the services-producing sector. Net job creation in both of these sectors recovered relatively well in historical standards.

Finally, it appears that employment in certain sub-sectors that were impacted by the Great Recession, and then assisted by the 2009 "American Recovery and Reinvestment Act (ARRA)", recovered faster than employment in the overall sector (e.g. construction and mining). Overall, however, the analyses do not point out to a clear-cut evidence that the ARRA was influential as some sectors continued to grow during the recession itself and, therefore, it is hard to attribute the post-recession behaviour of employment in these specific sectors to the ARRA.

Most existing studies on job creation focus on the micro-level or specific aspects of job creation. Davis *et al.* (1996) studied plant-level data of the U.S. manufacturing sector over 1972-1988 and described the characteristics that destroy and create jobs over time. Using data for the U.S. manufacturing sector between 1972 and 1986, Davis and Haltiwanger (1992) showed that the gross rates of job creation and destruction were both very high- roughly 10 percent of manufacturing employment in a given year. Haltiwanger *et al.* (2013) used data from the Census Bureau's Longitudinal Business Database (LBD) that track all firms and establishments in the U.S. nonfarm business sector for the period 1976 to 2005. Their main result was that, controlling for firm age, there was no inverse relationship between net job creation and firm size, thus challenging the widespread perception that small businesses create most jobs in the U.S. economy. Moscarini and Postel-Vinay (2012) studied the contributions of large and small U.S. employers at different stages of the business cycle and showed that the relative growth rate of employment at initially large and small firms was strongly negatively correlated with the aggregate unemployment rate. Basker (2005) showed that Wal-Mart entry had a small positive effect on retail employment at the county level and a small negative effect on wholesale employment. Saks (2008) found that housing supply regulations had lasting effects on metropolitan area employment in locations with relatively high degrees of housing supply regulations.

I take a different stand in this paper by considering NJC at the aggregate level, with the aim to better understand the ability of the U.S. economy to create jobs over time. In addition, the behaviour of the U.S. unemployment rate and NJC in recent years call for deeply studying their historical behaviour in order to put recent years in perspective. To my knowledge, this has not been addressed in the literature to date and this paper aims at filling this gap in the literature.

The remainder of the paper proceeds as follows. Section II presents the main results of the study about net job creation. Section III describes evidence about the unemployment rate and its co-movement with NJC. Section IV presents evidence about the labor force and its co-movement with NJC. Section V compares the sub-period December 2007-December 2011 with other sub-periods. Section VI discusses net job creation at the sectoral level. Section VII presents analyses about the NJC rate and section VIII concludes.

II. Net Job Creation

I use monthly data from the Bureau of Labor Statistics (BLS) for the period 1950:1-2011:12. The net job creation data are available in Table B-1 ("Establishment Data") and they measure the monthly change in total nonfarm payrolls. Data about private net job creation and government net job creation are also available in this table. All data are seasonally adjusted at the origin. I start by describing long-run trends since January 1950, and then move to comparisons across decades. I later discuss some of the important features of net job creation in the U.S. during the period studied. In what follows, shaded areas will indicate official U.S. recession dates as determined by the Business Cycle Dating Committee of the National Bureau of Economic Research (NBER).

Net Job Creation- An Overview

Fig. 1 shows the monthly U.S. NJC between January 1950 and December 2011. The key insight that comes out of this graph is that the monthly NJC did not exhibit any upward trend over time, as is well reflected by the almost horizontal trend line (with the note that there is a slight downward trend, which is mainly a result of negative NJC in 2008-2009). With the exception of certain months, NJC moved between (-300) thousand and 300 thousand a month, with most of the positive NJC being around 150-200 thousand per month.

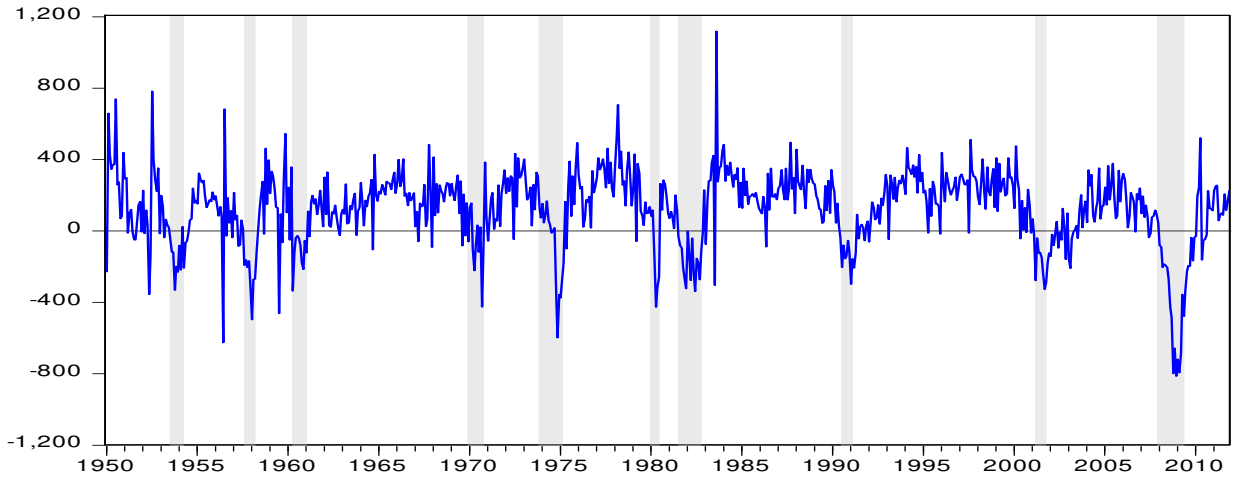

Fig. 1. The monthly NJC

The above finding is better seen in Fig. 2, which shows the average of monthly NJC by decade over the sample period. Taking all years into account, we clearly observe no significant increase in the monthly NJC since the 1960s. In fact, the average NJC during the 2000s was negative (and it is the only decade with negative NJC, on average), albeit very small. This finding can obviously be attributed to the Great Recession and the slow start of the decade,

but it is very noticeable when compared to the average of the 1970s (with two major recessions during that decade). In fact, the average of NJC during the 1970s was slightly better than the average of the 1980s and the second highest along the entire period considered (the 1990s were clearly the best).

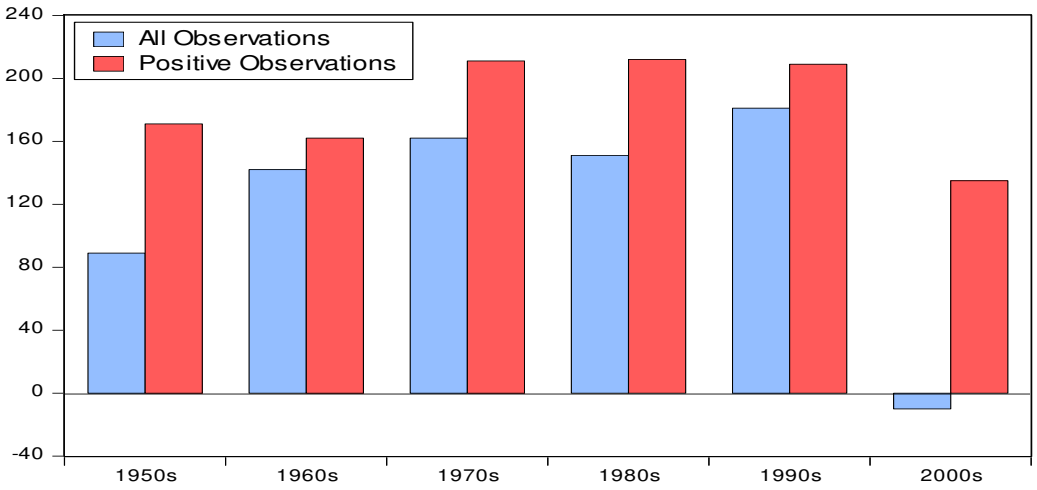

Fig. 2. The average monthly NJC by decade

In the light of the Great Recession and to put the 2000s in a better perspective, I also present the average monthly job creation for years with positive NJC only. We now see an improvement in the average of NJC between the 1960s and the following three decades. Interestingly, though, the average of NJC did not change during these three decades, moving around 210 thousand jobs a month. The 2000s emerge again as the weakest period, with an average of about 135 thousand a month, down by about 75 thousand a month (i.e. about 900 thousand jobs a year!) compared to the previous three decades. Therefore, the low NJC during the 2000s cannot be attributed only to the two recessions during that decade.

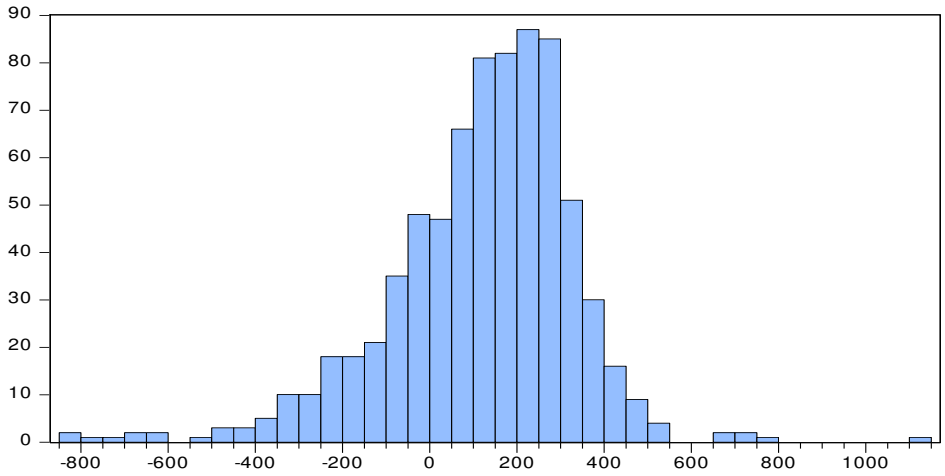

Fig. 3. The distribution of the monthly NJC by size

The fact that over six decades the average number of jobs created did not exhibit any significant trend is an interesting observation. Since 1950, the U.S. population and the labor force more than doubled. Yet, the size of the monthly net job gains in the economy did not change significantly. One possible explanation for this observation during the 2000s is the already low unemployment rate (before the last economic recession). When the economy is operating at a high employment rate, it is perhaps more difficult to increase net job creation. But, this is still interesting and it is certainly different from the picture that comes out of the 1990s.

Fig. 3 shows the distribution of the monthly NJC over the entire period, 1950:1-2011:12. First, among the 744 months reviewed, NJC was positive in 563 cases (i.e. about 76 percent of the time), negative in 180 cases and zero in one case. Second, in months with positive NJC, the most likely monthly job gain is between 100 thousand and 300 thousand. NJC of more than 300 thousand is significantly less likely and NJC of more than 400 thousand is very unlikely (happened only in 2.5 percent of the time). Third, in months with net job losses, the most frequent number of job losses is below 50 thousand a month. Job losses of more than 50 thousand are also very likely. Net job losses of at least 500 thousand are very unlikely. In fact, 6 out of the 9 occasions with net job losses of at least 500 thousand occurred during the recent economic recession (in the months 2008:11-2009:4).

Net Job Creation- Volatility of Monthly Changes

I now study the variation in the monthly net job creation over the period investigated. Fig. 4 shows the changes in NJC between two consecutive months. Clearly, moving from one month to the next, NJC can vary dramatically; the difference between two months can easily exceed 200 thousand in absolute value. Changes of up to 200 thousand remain the most likely figures, though. In either case, the changes are fairly big considering the frequency of the data.

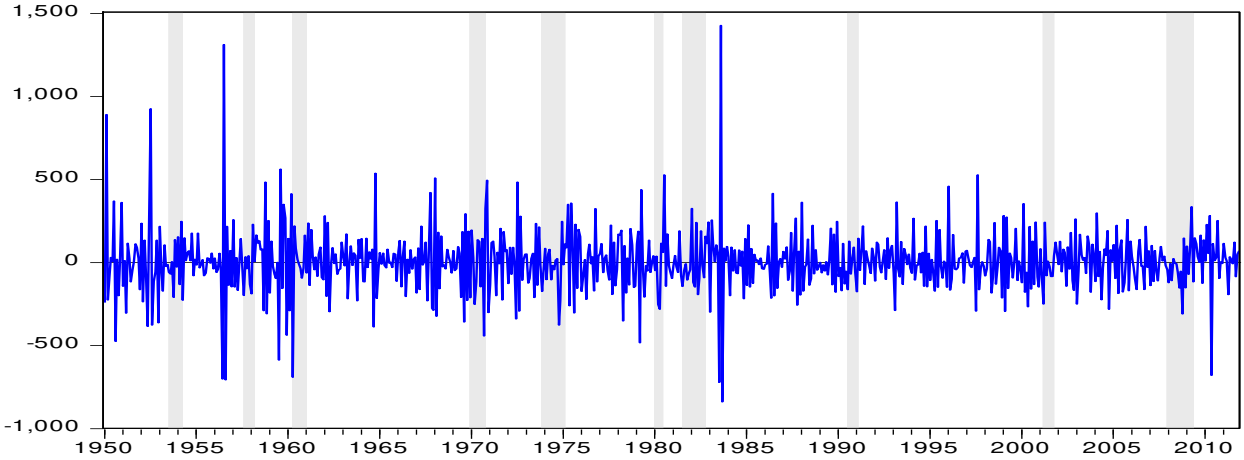

Fig. 4. The monthly changes in NJC

NJC may also change direction in the span of one month. In 63 cases, NJC became negative after being positive in the previous month. In 62 cases, NJC turned positive after being negative in the previous month. In 43 case, NJC moved from positive to negative and then to positive in three successive months. And, in 17 cases, the opposite happened. Therefore, not only that significant changes in the size of NJC are possible, but NJC can also change course very rapidly. Robust and steady NJC on a monthly basis is not the typical theme. In this regard, the standard deviation of the U.S. net job creation is 214 thousand.

The unrobust net job creation is also observed at the annual frequency: moving from one year to the next, NJC vary significantly (the sub-periods 1983-1989 and 1993-1999 serve as good examples). Therefore, even after "smoothing" the changes in net job creation by using low frequency data, the variation between two periods remains very significant. Interestingly, this variation may occur in a certain period of time even in the absence of any major economic event (e.g., sliding into a recession after a period of expansion).

Net Job Creation and Recessions

Table 1 reviews the behaviour of NJC following all U.S. recessions since 1950. On average, it takes roughly one quarter from the official end of a recession for NJC to become positive. However, in few occasions, moving to a month with positive NJC does not necessarily indicate a move into a period with positive NJC. For this reason, I also look at the number of months it takes to move to three consecutive months with positive NJC, a better indicator of robust NJC. In this case, it takes about 6 months on average to obtain a robust NJC. This number, however, is biased by the 2001:3-2001:10 recession as it took roughly two years to have 3 straight months of positive NJC. Excluding this recession, both the average and the median of the right column are 4 months. Still, it takes one third of a year after the official end of a recession to see 3 straight months of positive NJC.

Also, the numbers for the second half of the sample are higher. This includes even relatively short recessions as the 1990:7-1991:2 and the 2001:3-2001:10 recessions. NJC had been negative for 9 months in a row after the end of the Great Recession before turning into positive, the longest period along the entire sample. The fact that the recoveries of the labor market from the recent three recessions have been slower is well known, and it is famously called "jobless recoveries". In this regard, the table reveals that the recovery of the labor market from the Great Recession has actually been faster (in the sense that robust net job creation started after a shorter period of time) than the recovery from the 2001 recession, despite the clear differences in the length and the severity between the two recessions. This result is in line with finding of Abo-Zaid (2013), among others, in the discussion about "jobless recoveries".

Table 1. U.S. recession dates and the behaviour of NJC after the end of recessions

Recession	Number of months between the end of the recession and positive NJC	Number of months between the end of the recession and 3 consecutive months of positive NJC
1953:7-1954:4	4	4
1957:8-1958:3	3	3
1960:4-1961:1	1	3
1969:12-1970:10	1	4
1973:11-1975:2	4	4
1980:1-1980:6	1	1
1981:7-1982:10	2	4
1990:7-1991:2	3	5
2001:3-2001:10	7	22
2007:12-2009:5	9	9
Mean	3.5	5.9
Median	3.0	4.0

Net Job Creation- Monthly Averages

Even though the data are seasonally adjusted, I check whether NJC differs between different months within the year. Fig. 5 presents the average of NJC by month (for example, during 1950-2011, the average number of jobs created in January was 106 thousand). The weakest NJC usually occurs around the middle of a year, in June and July. NJC, thus, did slow down during the summer even after correcting for seasonality. On the other hand, March, April and November were better than the average. In addition, in 60 percent of the months reviewed, NJC in the first half of a year was higher than in the second half of that year. This is consistent with the fact that in 7 out of the 10 U.S. recessions reviewed above, the recessions started in the second half of the year (with 3 recessions starting in July).

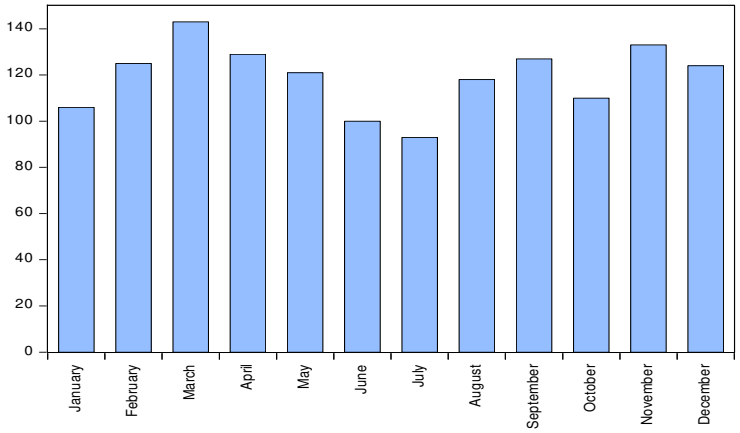

Fig. 5. NJC by month

Private, Government and Total Net Job Creation

This sub-section discusses net job creation in the economy by the private-sector and the government individually. I start by describing NJC in the private sector over the entire sample period (Fig. 6). Similar to total NJC, private-sector NJC showed no increase over time and it displayed big variation between two consecutive months. Most of the variation in total NJC, thus, is coming from the private-sector NJC, which is expected given the high proportion of private-sector employment in the total employment. Also, even though the volatility of government jobs is significantly lower than the volatility of private-sector jobs, the volatility in the government sector is very high relative to the mean (the Coefficient of Variation, the ratio of the standard deviation to the mean, is roughly 2). New government jobs act as a "shock absorber", thus reducing the overall volatility of NJC.

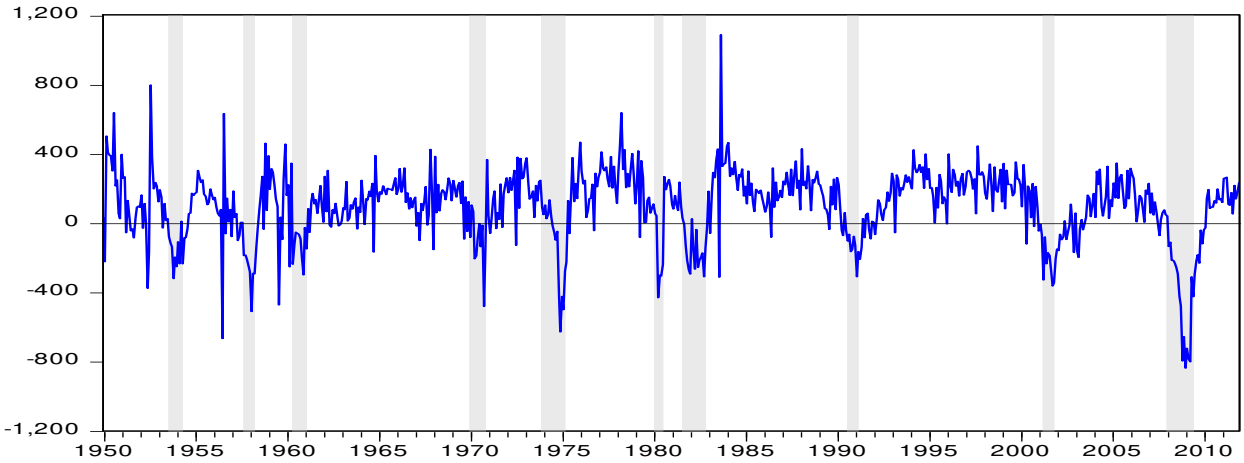

Fig. 6. The monthly private NJC

Table 2. Summary statistics of monthly total NJC, private NJC and government NJC, by sub-period

		1950:1-2011:12	1950:1-2007:11	2007:12-2011:12	2010:10-2011:12
Private	Mean	98	112	-110	172
	Median	129	139	-27	175
	Std. Dev.	207	189	318	65
Government	Mean	22	24	-7	-18
	Median	23	24	-9	-15
	Std. Dev.	46	41	89	27
Total	Mean	119	136	-116	153
	Median	148	159	-51	121
	Std. Dev.	214	194	319	67

Table 2 presents summary statistics of NJC of the government, the private sector and total NJC. Prior to December 2007, the private sector had been creating 5 out of every 6 new jobs, on average. The number of jobs gained in the government sector declined since the beginning of the Great Recession almost at the same pace as the newly created jobs in the private sector did. In fact, since October 2010, the average private-sector net job gain had been roughly 170 thousand, while government jobs kept declining by roughly 20 thousand each month, thus holding down the rise in total nonfarm jobs in the economy. Finally, the private-sector net job creation since October 2010 had been significantly higher than its long-run mean.

III. The Unemployment Rate

I now study the behaviour of the monthly unemployment rate and its correlation with net job creation. The unemployment rate and the civilian labor force data are obtained from Table A-1 ("Household Data") of the Bureau of Labor Statistics (BLS) over 1950:1-2011:12.

The Unemployment Rate- An Overview

The U.S. unemployment rate is depicted in Fig. 7. It rose since the mid 1950s, peaked during the early 1980s (passing the 10 percent landmark) and then experienced a drop until reaching roughly 4 percent in the late 1990s. The unemployment rate increased dramatically since 2007, reaching the peak of 10 percent in October 2009. At the end of the sample (December 2011), the unemployment rate stood at 8.5 percent.

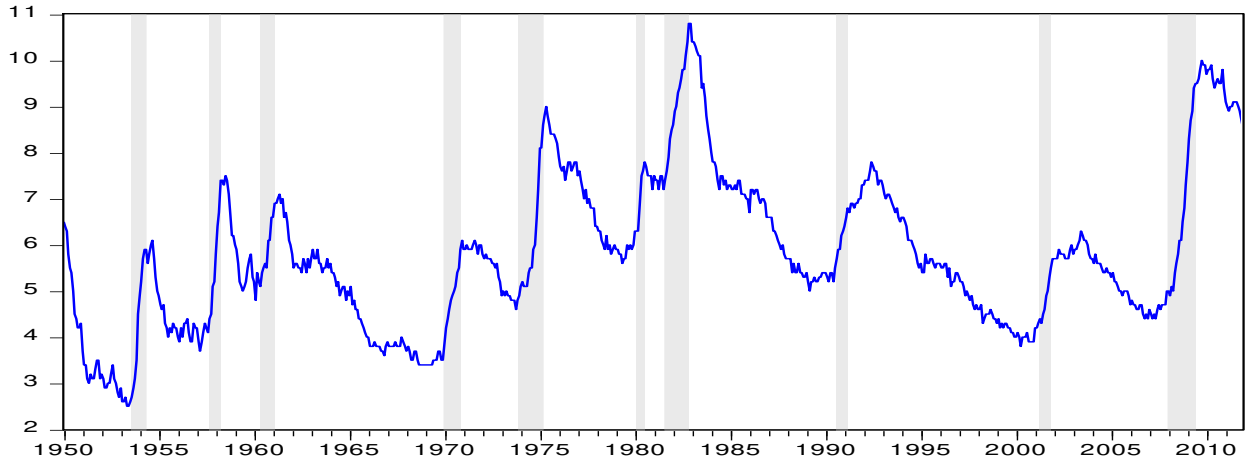

Fig. 7. The monthly unemployment rate

Fig. 8 presents the average unemployment rate by decade. The 1970s and the 1980s had the highest unemployment rates, on average, along the entire sample period (and they are the only decades with more than 6 percent, on average). The most interesting observation, however, is

that the average unemployment rate during the 2000s was the lowest since the 1960s. This is mainly interesting considering the fact that the U.S. economy lost jobs in net terms during this decade (see Fig. 2 above). This fact suggests that NJC may tend be lower (but not necessarily negative) when the unemployment rate is low as the economy is closer to its full potential. In either case, this is an interesting observation in and of itself.

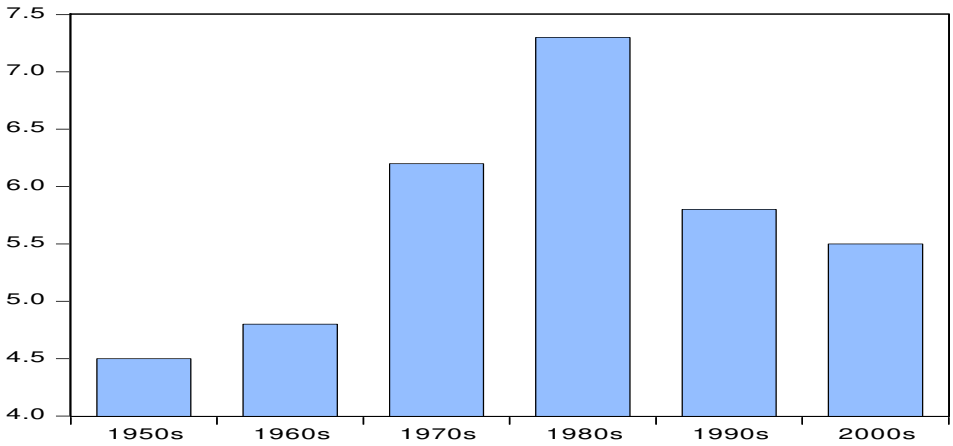

Fig. 8. The average unemployment rate by decade

Fig. 9 shows the distribution of the monthly changes in the unemployment rate. The main observations can be summarized as follows. First, in one fourth of the cases, the unemployment rate did not change between two consecutive months. Second, the unemployment rate dropped in about 40 percent of the time and rose in about 36 percent of the time. Third, the most likely change in the monthly unemployment rate is 0.1 percent (in absolute value). This is particularly true for monthly falls in the unemployment rate; in 53 percent of the months with falls in the unemployment rate, it dropped by 0.1 percent only. Monthly changes of 0.2 percent (in absolute value) seem also likely; they account for about one fifth of the observations.

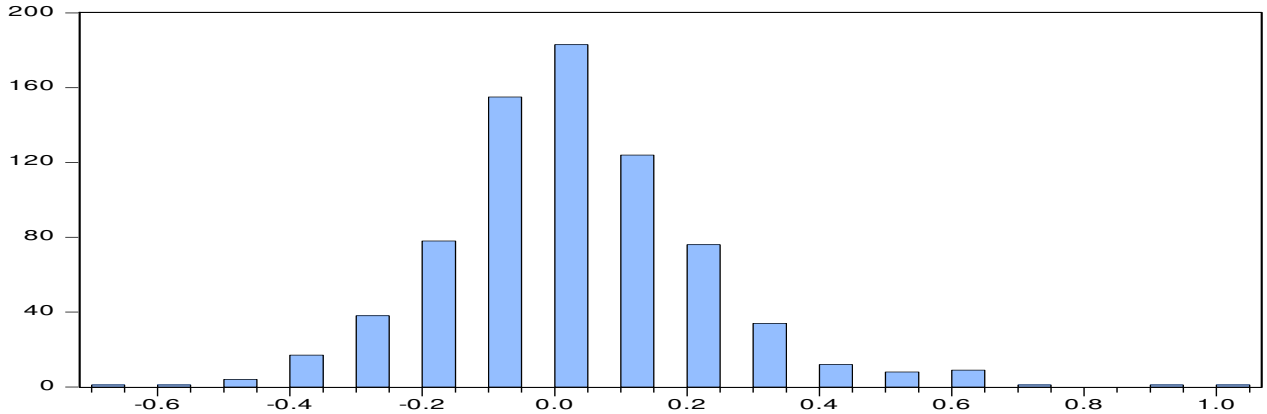

Fig. 9. The distribution of the monthly change in the unemployment rate

Together, in roughly 77 percent of the months with non-zero changes in the unemployment rate, it changed by either 0.1 or 0.2 (in absolute value). Drops of up to 0.2 occurred in about 80 percent of the months with negative changes in the unemployment rate, and increases of up to 0.2 occurred in about 75 percent of the months with positive changes in the unemployment rate. Fourth, while bigger changes in the unemployment rate are possible, they are significantly less likely to materialize.

Co-Movement Between Net Job Creation and the Unemployment Rate

The changes in the U.S. unemployment rate and their co-movement with NJC since the end of the Great Recession have been in the center of the discussions about the U.S. labor market. Motivated by this discussion, this sub-section studies the co-movement between NJC and the changes in the unemployment rate with the attempt to draw any useful insights that may help in putting the last four years in a better perspective.

Table 3. NJC and changes in the unemployment rate ($\triangle u$)

		$\triangle u > 0$	$\triangle u = 0$	$\triangle u < 0$	Total
1950:1-2011:12	Positive NJC	148	152	263	563
	Negative NJC	117	31	32	180
	Total	265	183	295	743
1950:1-1969:12	Positive NJC	44	43	93	180
	Negative NJC	38	9	13	60
	Total	82	52	106	240
1970:1-1989:12	Positive NJC	56	52	89	197
	Negative NJC	33	8	2	43
	Total	89	60	91	240
1990:1-2011:12	Positive NJC	48	57	81	186
	Negative NJC	46	14	17	77
	Total	94	71	98	263
1950:1-1983:12	Positive NJC	84	71	151	306
	Negative NJC	71	16	15	102
	Total	155	87	166	408
1984:1-2011:12	Positive NJC	64	81	112	257
	Negative NJC	46	15	17	78
	Total	110	96	129	335

Table 3 summarizes the main findings. In more than half of the occasions with net job gains, the unemployment rate did not decline in the same month. Actually, in one fourth of the occasions it increased despite net addition of jobs. In more than one third of the months with net job losses, the unemployment rate did not rise. In several occasions, the unemployment rate dropped despite losing jobs. Putting facts together, in 49 percent of the cases, the expected negative correlation between NJC and the change in the unemployment rate was not observed (in one fourth of the cases, even a positive correlation was observed between both). The table also reveals clear asymmetry: the likelihood that the unemployment rate will rise in a month with net job losses is significantly higher than the likelihood that the unemployment rate will fall in a month with net job gains.

This pattern holds for sub-periods: in Table 3, I also consider sub-periods of two decades each and re-do the above calculations. Once more, net job gains are not always associated with a decrease in the unemployment rate and the unemployment rate may fall despite net job losses. Furthermore, the proportions were stable over time and, therefore, the results for the full sample period are not biased by certain sub-periods. I then consider two time periods that are frequently examined in the literature in discussions about the "jobless recoveries" era-namely before and after 1984. Clearly, all the above findings hold here (in percentage terms, of course, because the second sub-period is shorter than the first): in more than half of the cases with positive NJC, the unemployment rate did not drop during the same month. And, increases in the unemployment rate in months with positive NJC are more likely than drops in the unemployment rate in months with negative NJC. [2]

The fact that the unemployment rate may increase in periods with net job gains implies a bigger increase, in percentage terms, in the labor force than in NJC during the same month. Furthermore, the fact that the positive correlation between net job creation and the change in the unemployment rate is mainly observed in months with net job gains lead to another interesting conclusion: the likelihood that the labor force expands more than the expansion of employment during periods of expansion is bigger than the likelihood that the labor force contracts more than the fall in employment during periods of contraction. In other words, when employment is increasing it is more likely to see more people joining the labor force than the probability to see people exiting the labor force when employment is falling.

To shed some light on the result of non-negative correlation in roughly half of the occasions between NJC and the changes in the unemployment rate, Table 4 presents more details about

[2]I also calculate the correlation coefficient between NJC and the chance in the unemployment rate for the entire period and for two types of sub-periods. I first consider sub-periods of two decades each; the correlation coefficient was roughly (-0.51%)-(-0.56%) for all sub-periods, suggesting that the correlation between these two variables had been stable over time. As for before and after 1984, the correlation coefficient had been around the (-50%) for both sub-periods. These calculations are available upon request.

the size of NJC for each of the full-sample entries of Table 3. For months with net job gains, the non-negative correlation between NJC and the change in the unemployment rate happened with different levels of NJC, with an average of 180 thousand (which is relatively high in historical standards). Furthermore, an increase in the unemployment rate with NJC of less than 100 thousand, 100-199 thousand and 200-299 thousand have almost the same likelihood, implying no dominant category in the first column of the table. Similarly, Months with no change in the unemployment rate despite net job gains occurred with an average of about 200 thousand jobs, but also with more than 200 thousand during the same month.

Table 4. Detailed Summary of changes in the unemployment rate and NJC. Note: the size of NJC is in absolute value

	Positive NJC			Negative NJC		
	$\triangle u > 0$	$\triangle u = 0$	$\triangle u < 0$	$\triangle u > 0$	$\triangle u = 0$	$\triangle u < 0$
NJC Mean	181	196	237	-207	-128	-67
NJC Median	154	197	228	-161	-93	-41
$\triangle u$ Mean	0.16	0	-0.18	0.27	0	-0.15
$\triangle u$ Median	0.10	0	-0.10	0.20	0	-0.10
Size of NJC	Number of observations			Number of observations		
< 100	45	30	37	39	16	26
100-199	41	47	75	30	9	2
200-299	38	54	80	23	2	3
300-399	17	18	46	11	3	1
≥ 400	7	3	25	14	1	0
Total	148	152	263	117	31	32

Months with net job losses featured a slightly different pattern: a fall in the unemployment rate despite net job losses is primarily likely when the economy loses up to 100 thousand jobs. A net loss of at least 200 thousand jobs is likely to be joined by an increase in the unemployment rate that month (happened in roughly 83 percent of the cases). Therefore, unlike the opposite case (simultaneous increases in NJC and the unemployment rate), a fall in the unemployment rate despite net job losses is mainly restricted to relatively small net job losses.

I close this sub-section with Fig. 10, which presents the monthly NJC vs. the change in the unemployment rate. The figure indicates a negative association between both variables, but the association is relatively low ($R^2 = 0.27$ and a small slope in absolute value). On average, the number of jobs required to keep the unemployment rate unchanged is roughly 125 thousand. Higher NJC, however, does not guarantee a drop in the unemployment rate: the first quadrant of the figure illustrates that net job gains can be associated with increases in the unemployment

rate even when NJC significantly exceeds 125 thousand. In sum, no clear pattern regarding the co-movement between NJC and the change in the unemployment rate in the U.S. is observed, particularly in months with net job gains.

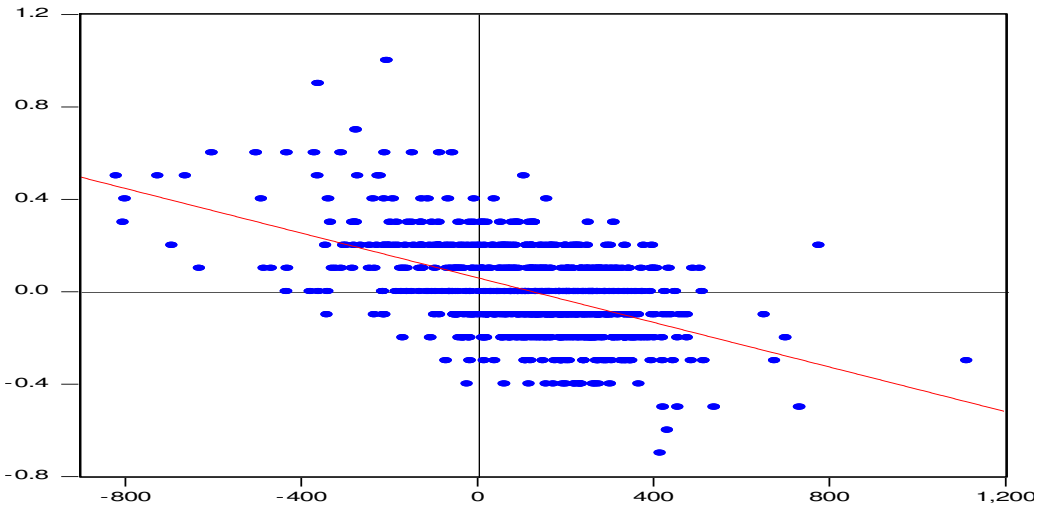

Fig. 10. NJC vs. the change in the unemployment rate

IV. The Labor Force

This section reviews the behaviour of the labor force in the U.S. over the sample period in an attempt to draw some useful insights about the behaviour of NJC. Fig. 11 shows the changes in the labor force ($\triangle LF$) along the entire sample period. Similar to the case with net job creation, the changes in the labor force did not feature a trend over time. Normally, $\triangle LF$ fluctuates each month within the range of (-200) thousand and 400 thousand. The average change and the median of $\triangle LF$ were 124 thousand and 123 thousand, respectively. The average of $\triangle LF$ is, therefore, very similar to the average of NJC.

As expected, the labor force is usually expanding. During the entire period considered, the labor force increased 511 times (which are 69 percent of the months) and contracted 233 times. No zero change in the labor force was recorded during the entire period. Recall that in roughly 76 of the cases, NJC was positive, implying that a decline in the labor force is (slightly) more likely than a decline in NJC.

I next study the co-movement between NJC and $\triangle LF$, summarized in Table 5. In 78 percent of the cases with positive $\triangle LF$, NJC was positive as well. In all remaining cases, but one, NJC was negative. On the other hand, NJC was negative in only 29 percent of the months with negative $\triangle LF$. In all remaining months, NJC increased during months with a declining labor force. This asymmetry in the co-movement of net job creation and the labor force is interesting;

they tend to rise together (in about 4 out of every 5 cases), but they do not tend to decline simultaneously as frequnetly.

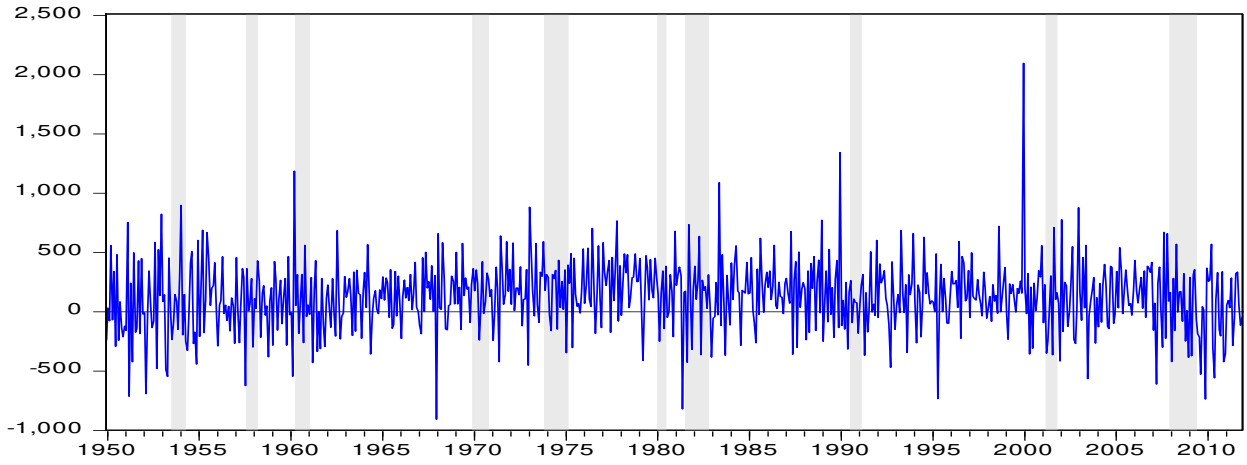

Fig. 11. The monthly changes in the labor force

Table 5. Detailed Summary of changes in the labor force and NJC. The size of NJC is in absolute value. Note: no observation with $\triangle LF = 0$

	Positive NJC		Negative NJC	
	$\triangle LF > 0$	$\triangle LF < 0$	$\triangle LF > 0$	$\triangle LF < 0$
NJC Mean	150	360	-171	-165
NJC Median	155	337	-125	-102
$\triangle LF$ Mean	277	-168	240	-265
$\triangle LF$ Median	237	-140	213	-231
Size of NJC	Number of observations		Number of observations	
< 100	112	0	48	33
100-199	163	0	27	14
200-299	123	49	17	11
300-399	0	81	11	4
≥ 400	0	35	9	6
Total	398	165	112	68

The fall in the labor force during periods of expanding employment may result from a lag in the behaviour of the labor force relative to employment. Consider, for example, recent years- the economy is gaining jobs, but the labor force is actually declining, albeit moderately. Discouraged people may exit the labor force if they feel that, even though the economy is gaining jobs, this gain is not big enough for them to find jobs. This process may continue until NJC becomes very robust and growing in magnitude.

V. December 2007-December 2011 in a Historical Perspective

This section attempts to put the period since the onset of the Great Recession into a good perspective. For this purpose, I present summary statistics about net job creation, the change in the labor force and the change in the unemployment rate during this period and compare them to historical data. Table 6 presents some descriptive statistics for the entire period investigated, the period prior to the Great Recession, the period since the official start of the Great Recession (December 2007) and the period since the end of negative NJC (which is September 2010).

Table 6. Summary of NJC and changes in the unemployment rate

		1950:1-2011:12	1950:1-2007:11	2007:12-2011:12	2010:10-2011:12
NJC	Mean	119	136	-116	153
	Median	148	159	-51	121
	Std. Dev.	214	194	319	67
$\triangle LF$	Mean	124	132	1	-2
	Median	123	135	28	28
	Std. Dev.	294	292	302	250
$\triangle u$	Mean	0.00	0.00	0.08	-0.07
	Median	0.00	0.00	0.10	-0.10
	Std. Dev.	0.20	0.20	0.23	-0.17

Clearly, since the start of the Great Recession, net job losses had been very high; on average, the economy has lost about 1.4 million jobs each year. This average, however, is highly biased because of 2008-2009 as can be understood from the median value (an average loss of 612 thousand jobs a year). During this period, the difference between the median and the mean had been very large compared to the period before December 2007. In addition, during this sub-period, NJC displayed higher volatility than in the first sub-period (this can also be confirmed by considering the Coefficient of Variation).

Prior to the Great Recession, the labor force had been expanding by an average of 1.6 million each year. Since the beginning of the Great Recession, however, there had been virtually no growth in the labor force (increased by only a total of roughly 50 thousand since late 2007). The volatility in the change in the labor force increased only slightly, but the Coefficient of Variation increased dramatically. Also, despite being higher than the average, the median change in the labor force had been relatively muted and significantly lower than its historical value.

Since June 2009, the economy had been gaining roughly 0.5 million jobs a year and it stabilized compared to 2007:12-2009:5. However, even though NJC had been positive on average since June 2009, the economy suffered from multiple months with net job losses between June 2009

and September 2010. The latter was the last month with negative NJC. For this reason, the last column of Table 6 considers the period since October 2010. Clearly, NJC speeded up and, on average, it had been very similar to its long-run average. NJC also became very stable compared to the recession period and compared to its historical behaviour.

Interestingly, during the period of the recession, the labor force kept increasing (by more than 50 thousand each month, on average). However, since June 2009, the labor force was shrinking despite the official end of the recession (declined by about 900 thousand). This fact may be attributed to the high unemployment rate, that persisted since the official end of the recession, which eventually led people to exit the labor force. The latter showed virtually no change since the third quarter of 2010.

VI. Net Job Creation by Sector

In this sub-section, I re-do some of the above analyses at the sectoral level. It is interesting to examine whether the main findings at the aggregate level continue to hold when certain sectors of the economy are considered. I will also try to connect the results of these analyses to any related policies in the U.S. To carry on the basic analyses, I focus on the largest sectors of the U.S. economy by the share of the employment in each sector in total employment.

Net Job Creation by Sector- An Overview

Historically, roughly 83 percent of the employment in the U.S. is either in the goods-producing sector or the private services-providing sector, with each sector including other sub-sectors as shown in panels four through thirteen of Table 7. Consider first the good-producing sector; while, historically, its share in total employment is considerably lower than the share of the service-providing sector, during the recent economic meltdown, the decline in the private goods-producing employment had been considerably bigger than the decline in the employment in the services-providing sector. Particularly, roughly two thirds of the fall in total employment occurred due to a fall in the employment in the goods-producing sector.

Most of the employment in the goods-producing sector is in the manufacturing and construction sub-sectors. Indeed, they accounted for almost all the fall in employment in the goods-producing sector during the recent recession. Interestingly, while the employment in the construction sub-sector is less than half of the employment in the manufacturing sub-sector, both showed similar declines in employment during the recession, which reflects the severity of the crisis in the real estate sector during this episode. As the economy started to rebound, however, the number of jobs created in the manufacturing sub-sector became again twice the number of jobs created in the construction sector.

Another interesting observation is the decline of employment in the manufacturing sector over time. Basically, along the past six decades, the average NJC in this sector had been zero. This result reflects an increase in the manufacturing employment in the beginning of the sample, stability between the late 1960s and the late 1990s, and a sharp decline since the late 1990s. For illustration, the employment in the manufacturing sector in December 2011 was lower by 40 percent than its peak in June 1979. And, the employment in this sector in November 2007 was lower by 30 percent than its peak.

I turn now to discuss the services-providing sector. First, along the full sample period, employment in education services and health care and social assistance kept growing with a relatively muted volatility. More interestingly, they had not been affected by the Great Recession as other sectors did. Employment in both sectors continued to grow during this economic meltdown, and in the aftermath recovery, at roughly the pre-crisis pace. This perhaps reflects the importance of these sectors given their nature as "necessity" services.

Second, employment in the wholesale trade, retail trade, financial activities, and professional and business services dropped markedly during the recent economic recession. Since the start of the recovery, these sectors, with the exception of financial activities, gained steam and the growth in employment in these sectors (most notably, the professional and business services sector) had been at least as high as the historical average. Financial activities had a far slower growth in employment compared to other sectors and to the historical average of employment in this sector, reflecting the troubles in this sector during the financial turmoil.

Finally, the employment in the transportation sector declined during the recent recession, but it rebounded nicely in historical standards. Interestingly, employment in hospitality and leisure remained virtually unchanged during and in the aftermath of the recession. This finding might be a bit surprising given the nature of these services as primarily "luxuries": one would expect a sharp decline in this sector as people delay or cancel leisure plans during times of economic uncertainty. While this happened during the peak of the recession, employment in this sector rebounded relatively quickly, certainly compared to employment in other sectors and total nonfarm employment.

Public Policies and Net Job Creation by Sector

I now examine the behaviour of net job creation by sector and relate it to public policies. In particular, I consider the behaviour of net job creation in various sectors before, during and in the aftermath of the Great Recession and study whether the 2009 "American Recovery and Reinvestment Act (ARRA)", commonly referred to as the "Stimulus Package", did help the employment in certain sectors in comparison with other sectors of the economy. The ARRA was signed into law in February 17, 2009.

Table 7. Summary statistics of monthly NJC by sector

Sector	Statistic	1950:1-2011:12	1950:1-2007:11	2007:12-2011:12	2010:10-2011:12
Total Nonfarm	Mean	119	136	-116	153
	Median	148	159	-51	121
	Std. Dev.	214	194	319	67
Goods Producing	Mean	3	8	-77	30
	Median	12	14	-46	28
	Std. Dev.	119	116	126	30
Private Services-providing	Mean	96	104	-26	159
	Median	103	105	43	158
	Std. Dev.	117	104	202	46
Construction	Mean	5	8	-39	7
	Median	8	10	-33	4
	Std. Dev.	40	38	51	22
Manufacturing	Mean	-2	1	-40	16
	Median	2	4	-21	12
	Std. Dev.	92	93	74	12
Wholesale trade	Mean	5	6	-9	10
	Median	6	7	-6	9
	Std. Dev.	11	10	18	6
Retail trade	Mean	14	16	-17	19
	Median	16	17	-6	16
	Std. Dev.	30	28	44	22
Financial activities	Mean	8	9	-11	3
	Median	8	8	-10	4
	Std. Dev.	11	9	17	8
Professional and business services	Mean	20	22	-8	55
	Median	18	18	11	51
	Std. Dev.	35	29	74	24
Leisure and hospitality	Mean	15	16	1	27
	Median	14	14	2	29
	Std. Dev.	25	24	34	21
Transportation	Mean	2	4	-4	7
	Median	5	5	1	7
	Std. Dev.	20	21	16	5
Educational services	Mean	6	6	7	11
	Median	7	7	9	11
	Std. Dev.	11	11	12	12
Health care and social assistance	Mean	30	31	26	21
	Median	31	32	26	24
	Std. Dev.	12	11	11	13

About two thirds of this package had been in the form of spending and the rest in the form of tax cuts to individuals and business. In this sub-section, I will focus on the spending part of the law. The package aimed at primarily helping the following sub-sectors: health care, education, infrastructure (mostly for transportation), energy and housing. To the extent possible, I will discuss here the behaviour of employment in these sectors since the beginning of the Great Recession in 2007. I then compare the behaviour of NJC in these sectors to NJC in other sectors that have not been targeted by the ARRA.

Often times, the BLS data are not disaggregated enough to allow for complete distinction between employment in the various sub-sectors. For this reason, I will use the closest possible data to track employment in the sub-sectors that were assisted by the ARRA. For example, construction of highways, bridges and streets is part of the Highway, Street, and Bridge Construction sub-sector (NAICS 2373), but the data about employment in this narrow sub-sector is not available. For this reason, I will present data on the "Heavy and Civil Engineering Construction" sub-sector, which includes the above. Similarly, I will consider the employment in the narrow sub-sector of Oil and Gas Extraction (NAICS 2111) in addition to the general mining sector to examine the effects of the package on employment in the energy sector.

To focus on the Great Recession, Table 8 presents the analyses for the period since December 2007. In particular, I divide this period into the official recession sub-period (2007:12-2009:5) and the period since the end of the recession (2009:6-2011:12). I also consider the period since October 2010 for the reason mentioned above. Because the ARRA was signed into law three months before the end of the recession, any possible effects on employment would primarily be observed during the second sub-period. For this reason, it will be particularly interesting to compare the behaviour of employment in the various sectors since mid 2009.

Consider first NJC in the general construction sector. Clearly, employment dropped dramatically and continued to fall after the official end of the recession. However, employment in the sub-sector of heavy and civil engineering construction recovered faster than the total employment in the construction sector. As mentioned above, this sub-sector was the target of government aid as part of the ARRA. Therefore, when it comes to parts of the construction sector, it does appear than government assistance was helpful in making its employment recover faster than the overall economy.

The employment in the transportation sector recovered relatively well following the end of recession. NJC in the educational services and the health care and social assistance sectors continued to be positive during and in the aftermath of the recession. NJC in the oil and gas extraction sub-sector was virtually zero on average. Therefore, we cannot say that the ARRA was important for these sectors (or to what extent it was important), but we are also unable to know what would have happen, over time, if the ARRA was not implemented.

Table 8. Summary statistics of monthly NJC by sector and the ARRA

Sector	Statistic	2007:12-2009:5	2009:6-2011:12	2010:10-2011:12
Construction	Mean	-79	-16	7
	Median	-66	-6	4
	Std. Dev.	45	39	22
Heavy and civil engineering construction	Mean	-8	0	2
	Median	-8	1	3
	Std. Dev.	7	7	7
Transportation	Mean	-15	2	7
	Median	-14	5	7
	Std. Dev.	14	14	5
Educational services	Mean	7	7	11
	Median	8	10	11
	Std. Dev.	12	13	12
Health care and social assistance	Mean	32	22	21
	Median	34	24	24
	Std. Dev.	10	10	13
Oil and gas extraction	Mean	0	1	1
	Median	1	1	2
	Std. Dev.	2	1	1
Mining	Mean	-2	4	7
	Median	0	6	7
	Std. Dev.	9	6	5
Manufacturing	Mean	-105	-2	16
	Median	-79	7	12
	Std. Dev.	76	36	12
Financial activities	Mean	-25	-4	3
	Median	-22	-4	4
	Std. Dev.	17	11	8
Professional and business services	Mean	-82	34	55
	Median	-66	44	51
	Std. Dev.	63	40	24
Leisure and hospitality	Mean	-24	14	27
	Median	-24	22	29
	Std. Dev.	29	29	21
Total Nonfarm	Mean	-384	39	153
	Median	-318	85	121
	Std. Dev.	303	206	67

I turn now to discuss other sectors in the economy that received little or no assistance through the ARRA. The manufacturing, financial activities, leisure and hospitality and the professional and business services sectors had considerable loss of jobs during the recession. However, while the latter two sectors recovered with the end of the recession, employment in the former two sectors continued to decline after the end of the recession. Furthermore, total nonfarm NJC had been positive on average since the end of the recession, albeit low in historical standards.

Fig. 12 shows the behaviour of employment (in levels, rather than the change in employment) since the beginning of the Great Recession. In particular, the figure presents the percentage deviation of sectoral employment each month from its pre-recession (i.e. November 2007) level, with the employment of each sector in November 2007 being normalized to zero. The shaded area indicates the recession period.

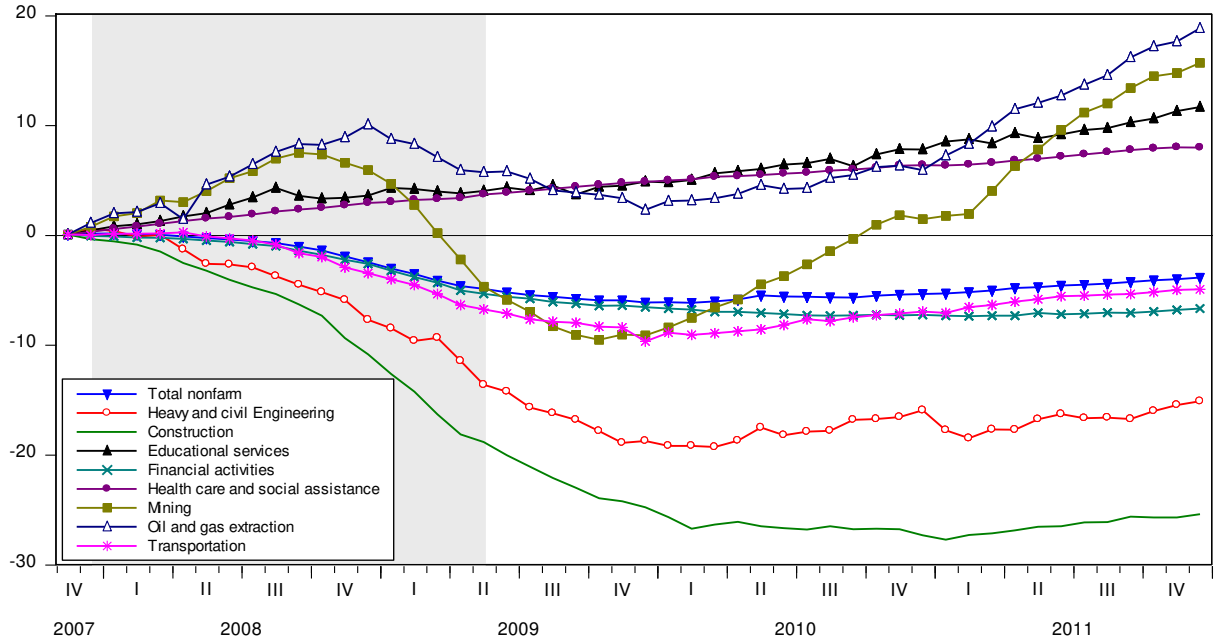

Fig. 12. The percentage deviation of employment from pre-recession levels

The figure reveals the following observations. First, the employment in certain sectors (e.g. education services and health care and social assistance) continued to grow during the recession (almost at the pre-recession pace), which is line in with the above findings. Second, employment in mining and oil and gas extraction slowed down during the recession, but it recovered relatively quickly, with employment in both sectors exceeding pre-recession levels around 2010. The zero NJC in the oil and gas extraction sub-sector reported above reflects a rise in its employment in 2008 and a decline in 2009. The employment in this sub-sector, however, remained above pre-recession levels after this decline. Third, employment in transportation and heavy and civil engineering construction had been declining until the second half of 2009, but it started

to recover at that time. At the end of sample period, however, employment in both sectors was below pre-recession levels (with the note that the heavy and civil engineering sub-sector outperformed the overall construction sector). Fourth, employment in the financial activities sector continued to decline after the end of the recession before starting to stabilize.

In general, the discussion here does not point out to strong evidence that the ARRA "made the difference" for the behaviour of employment between sectors (or sub-sectors) that received assistance and others that did not. On the other hand, the analysis certainly does not point out to a lack of significance of the stimulus package either. Within some sectors (e.g. construction and mining), it appears that the sub-sectors that were assisted by the ARRA recovered faster than the overall sector. The lack of inconclusive results stems primarily from the fact that employment in some sectors continued to rise during the recession (i.e. before the ARRA was passed) and the fact that employment in some sectors reversed course in late 2009 even though they did not receive government assistance. Focusing on the sectors that had been affected by the economic recession, however, the analyses of this section suggest that the ARRA has probably been helpful for the recovery of employment in these sectors.

VII. Net Job Creation Rate

This section studies the NJC rate to see whether the main results of the paper are robust to the normalization of NJC by the size of employment. I define the NJC rate for a month t as the ratio of NJC of month t over the average of employment in months *t-1* and *t*. In so doing, I follow Davis *et al.* (2006), but with a different data frequency.

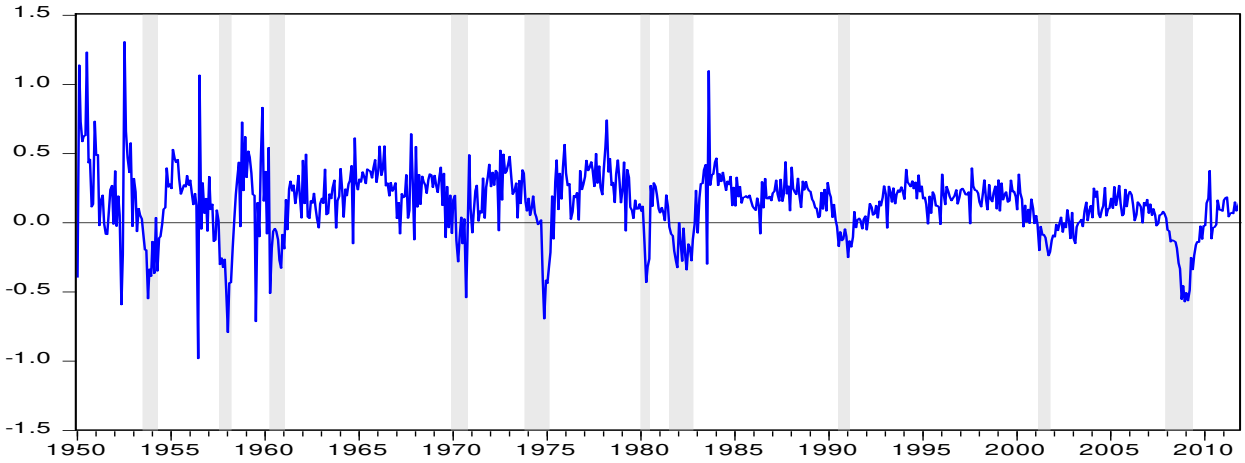

Fig. 13. The monthly NJC rate (in percents)

The monthly NJC rate is presented in Fig. 13. Up to the late 1970s, the NJC rate fluctuated mainly in the range of (-0.5) percent to 0.5 percent a month, but it did not exhibit any significant

trend during this period. Noticeably, the fluctuations during the 1950s had been relatively big compared to other years. Since the mid 1980s, the NJC rate started to decline at the same time that the fluctuations became smaller (with the latter reflecting the "Great Moderation" era).

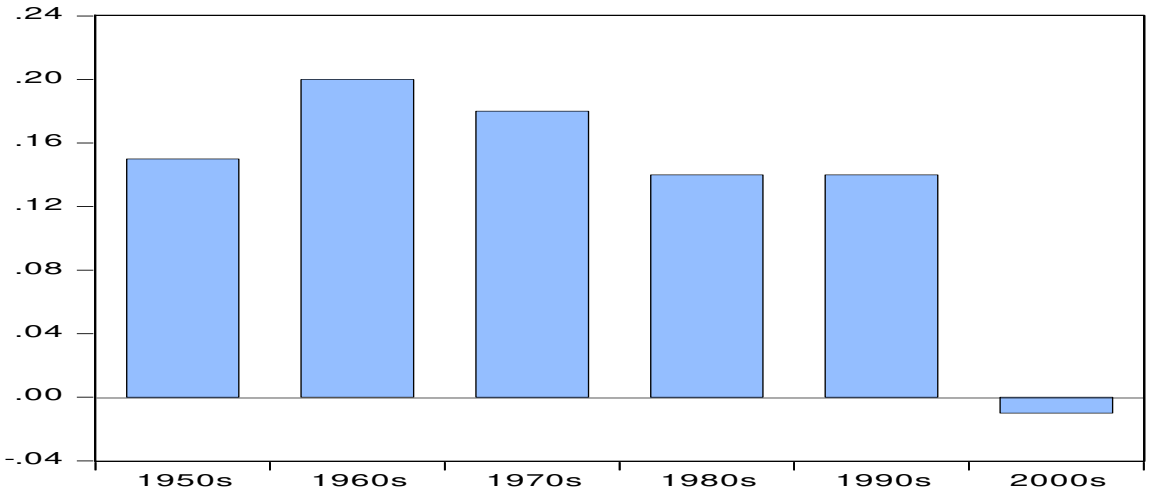

Fig. 14. The average monthly NJC rate by decade (in percents)

Fig. 14 shows the average monthly NJC rate by decade. We again observe the decline in the NJC rate since the 1970s. The NJC rate was very low during the 2000s, including the period between the two economic recessions. This is another confirmation to what had been shown in previous sections about the low net job creation even with the exclusion of 2001 and 2008-2009. These years were clearly weak compared to the preceding decades.

VIII. Conclusions

In this paper, I study the behaviour of the monthly U.S. net job creation over the period 1950-2011, both at the aggregate level and the sectoral level. The paper attempts to put the recent behaviour of net job creation and its co-movement with the changes in the unemployment rate and the labor force in a better perspective. The paper then focuses on the possible effects of the 2009 American Recovery and Reinvestment Act (ARRA) on the recovery of employment from the Great Recession in order to asses its effectiveness in stimulating employment.

The paper has few key findings. First, despite the considerable increase in the size of the U.S. population and the labor force since 1950, the average monthly NJC did not exhibit a significant trend over time, mainly since the 1960s. Second, NJC showed large variations in the span of one month, possibly moving from positive to negative and vice versa. Third, no clear association between the evolution in NJC and the change in the unemployment rate in the same month was observed: in more than half of the months with net job gains, the unemployment rate did not fall. And, in more than one third of the months with net job losses, the unemployment rate

did not rise. Fourth, since September 2010, which was the last month with negative NJC, the average of NJC had been higher than the historical average. Fifth, the analyses at the sector level reveal possible effects of the ARRA on the employment in the sectors that were assisted by the package, but the overall evidence is not conclusive enough. Finally, in more than 50 percent of the months with falls in the unemployment rate, it dropped by 0.1 percent only. Changes of 0.2 percent (in absolute value) are also very likely, but changes of more than 0.2 percent are considerably less likely.

This paper is part of an effort to study the U.S. net job creation and the unemployment rate in an attempt to better evaluate their recent behaviour as the economy is recovering from the Great Recession. In addition, the paper attempts to shed some light on the debatable public policies of recent years in stimulating economic activity and employment. These are very timely issues, thus magnifying the importance of this study.

Acknowledgements

I am grateful to the editor, Mark P. Taylor, and an anonymous referee for invaluable comments and suggestions.

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